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Controlling Changing Climates: Consumer Preferences for an Energy-Saving Garment

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Background

According to the United States Department of Energy (DOE), 12% of domestic energy use is consumed for heating and cooling building spaces. Additionally, the electricity use associated with cooling and heating these spaces totals more than 70% and contributes to about 40% of CO_2 emissions (buildingsdatabook.eren.doe.gov). Therefore, there is an urgent need to develop solutions that allow building occupants to reduce energy consumption while also achieving satisfaction with their thermal environment. Personal clothing is a part of an individual's thermal comfort system and can serve as a viable solution for building energy savings since it can provide a sense of personal environmental control. ***The purpose of this study was to evaluate consumer perceptions of a proposed technology-driven thermoregulatory garment.*** The study is part of a three-year project and the findings presented here are based on the first year's data.

Thermal comfort can have several contributing factors related to clothing including garment design, the number of garments, fabric weight and feel, and individual body heat. There are psychological considerations that can also impact thermal comfort via biofeedback, and the development of advanced clothing embedded with technology for use in interior environments would also introduce additional psychological considerations associated with consumer behavior, particularly issues associated with fashionability, usability, and innovation adoption. The adoption and use of technology-enabled clothing has similarities with both usability research (consumer as user) and technology adoption (innovative products). Rogers (1971) model of innovation diffusion was used as a framework for this study since the early stages of this model related to knowledge (acquisition of information) and persuasion (formation of favorable or unfavorable opinions) in consumer decision-making are attributes that can predict the likelihood of consumer adoption.

Objectives

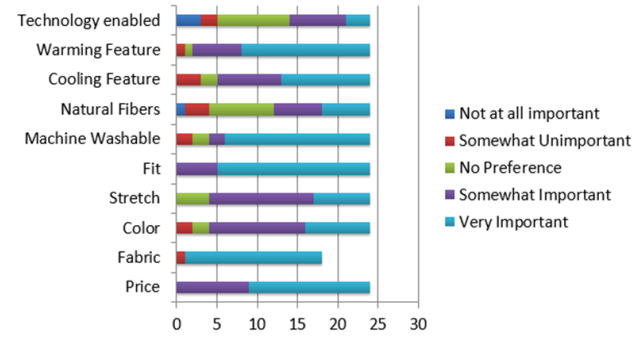
The proposed thermoregulatory garment used in this study consisted of a base layer undershirt embedded with micro tubes that would provide cool or warm air blown from an electro-mechanical device (or EMD). The EMD would be capable of detecting the wearer's skin temperature in order to maintain a comfortable thermal state. The purpose of this first phase of the study was to conduct an evaluation of initial consumer perceptions to the garment before development of the first prototype. The evaluation included the following aspects that would align with the early stages of innovation adoption and help inform development of the first prototype:

- Defining desired design and innovation features of the garment (Persuasion)
- Compiling a preliminary list of overall consumer preferences
- Consumer readiness for the technology-enabled garment (Persuasion)

Method

For this initial portion of the study, qualitative methods were used to explore how consumers envision wearable technology and could inform the product development process to meet consumers' expressed needs. The methods used were also selected to evaluate which garment aspects consumers would reference to make a usage decision (as part of the Persuasion stage). Participants were recruited using flyers and direct e-mail messaging. Participants were males and females between the ages of 18-65. Those working in office settings were targeted for recruitment since this population has experience in the spaces identified by the DOE as the largest energy consumers. Both individual interviews (n=24) and focus groups (n=15) were used to gather data on preferences. Interviews also included a short survey to allow participants to identify features they preferred. Focus groups involved creation of storyboards by participants to allow them to convey ideas visually that could not be expressed verbally as part of the group. A mock-up sample of the proposed garment was also developed to provide participants with information about the garment (knowledge) during interviews and focus groups.

Figure 1. Consumer Preferences



Findings

Categories of the desired design and innovation features from the interview data included (1) ease of use, (2) compatibility with one's wardrobe and other technologies, (3) quality and longevity of both the garment and the technology, and (4) the design of the technology interface as well as the garment's fit and fabric hand. Consumer preferences from the short survey are presented in Figure 1 based on level of importance. Consumer readiness for the garment was evaluated with a single question*: "If this type of garment was available on the market now would it be useful to you? Why or why not?"* The percentage of participants (40%) that would not adopt the garment was only slightly higher than the percentage of those that would adopt the garment (35%). Main reasons for not adopting the garment included the bulkiness of the EMD, the need to monitor the functions of the technology, and the proximity of the device to the skin. Storyboards provided visual data that indicated preferred design features that would address thermoregulation in specific body areas (e.g. under arms) as well as alternative locations for embedded technology. Overall, this preliminary assessment of the mock-up reflects a limited view of the potential for the proposed garment, but will aid in development of an initial prototype. Further evaluation of a completed prototype will likely provide a more robust measure of consumer preferences and readiness.

References

Rogers, E. M. (1971). *Communication of innovations: A cross-cultural approach*. New York: Free Press.